

# ***Integrating Risk and Knowledge Management: Lessons Learned***

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**One should expect that the expected can be prevented, but the unexpected should have been expected.**

**Norman Ralph Augustine**

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# ***Integrated Risk & Knowledge Management Practices***

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**Practice 1: Continuous Risk Management**

**Practice 2: Process 2.0**

**Practice 3: Knowledge-Based Risks**

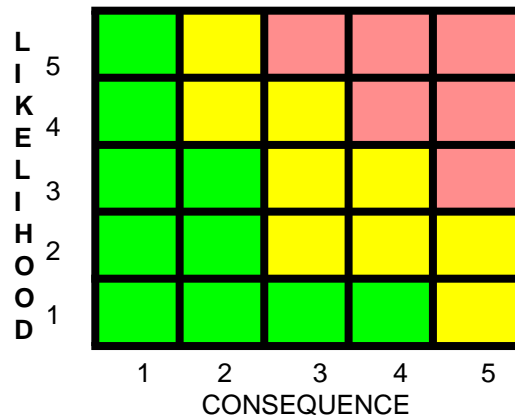
**Practice 4: Web-Enabled Teams**

**Practice 5: Knowledge Sharing Forums**

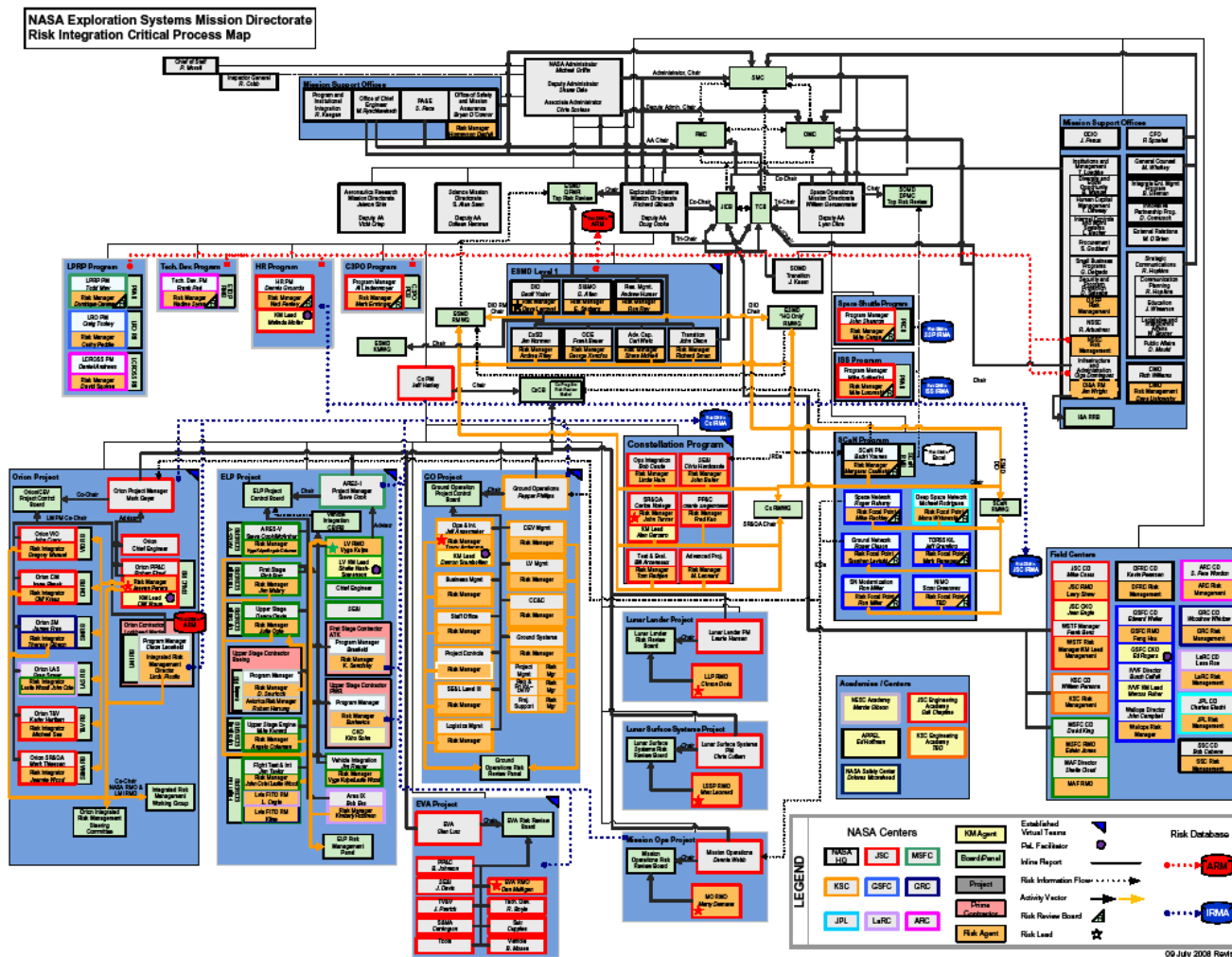
**Practice 6: Risk Management Case Studies**

# Practice 1: Continuous Risk Management (CRM)

- CRM is performed at all levels (Directorate, Program, Project, and below)
- Utilizing an enterprise risk management approach
- Perform horizontal integration thru extensive network of risk management working groups
- Perform vertical integration thru escalation process
- Approximately 1000 open risks across ESMD



# ESMD Risk Management Critical Process Map



.....understanding critical information pathways and organizational interfaces.....

## ***Practice 2: Process 2.0***

### ***Plan, Do, Check and Reflect***



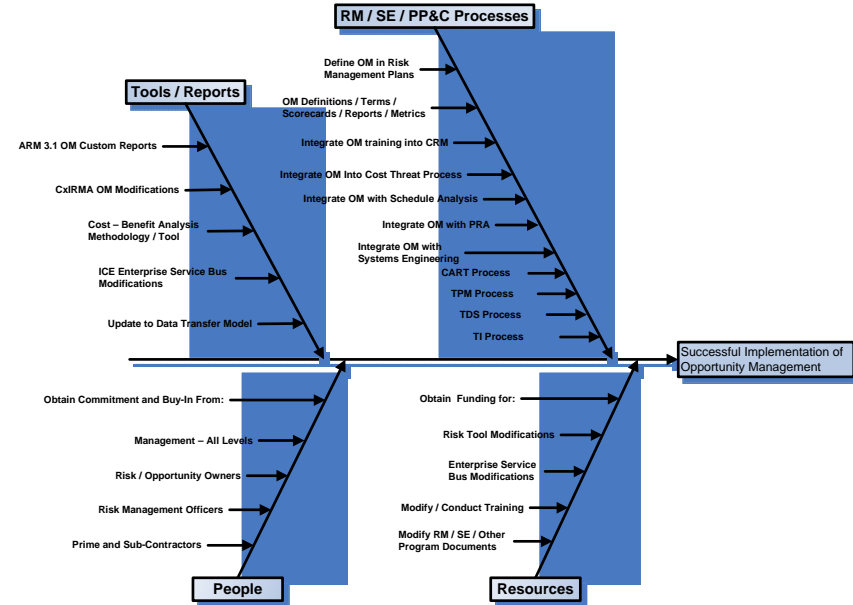
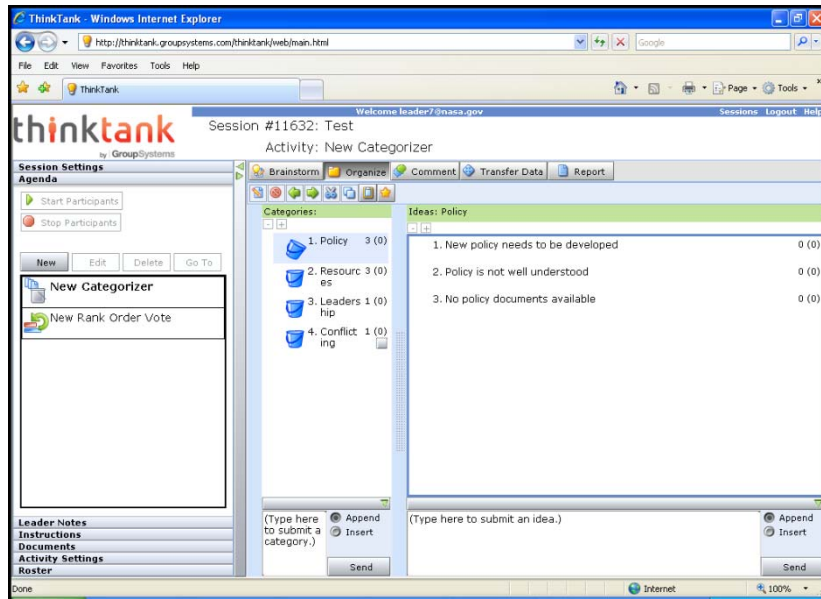
<https://ice.exploration.nasa.gov/ice/site/km/pal/>

**Goal: Rapid Work  
Process Improvement  
Through Structured, Time  
Managed Reflection**

**ESMD is promoting P2O  
through facilitator training  
at the center / program /  
project Levels**

**ThinkTank meeting  
collaboration software  
has been integrated into  
the process as required**

# Process 2.0 Tools



- **ThinkTank meeting collaboration software**
  - ESMD provides software access and technographer training
- **Fishbone Diagram – or – Ishikawa Diagram**
  - Structured logic techniques allow visualization of “less than adequate” processes / issues

## ***Practice 2: Knowledge-Based Risks***

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### ***Definition***

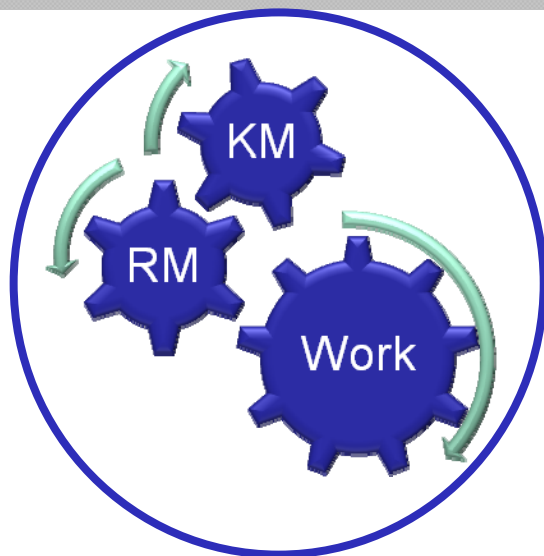
#### **Knowledge-Based Risk *n*.**

1. A risk record, with associated knowledge artifacts, that provides a story-telling narrative of how this risk was mitigated – and – what worked or didn't work.
2. A means of transferring knowledge in a risk context.

# ***Knowledge-Based Risks Strategy***

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1. Integrates the existing Continuous Risk Management (CRM) paradigm with knowledge management
2. Convey risk-related lessons learned and best practices to ESMD personnel
3. Focuses on integrating transfer of knowledge through existing work processes – is recursive in nature
4. Does not add an additional burden to the workforce to incorporate new KM tools and concepts



**Perform CRM...**

**Capture Lessons...**

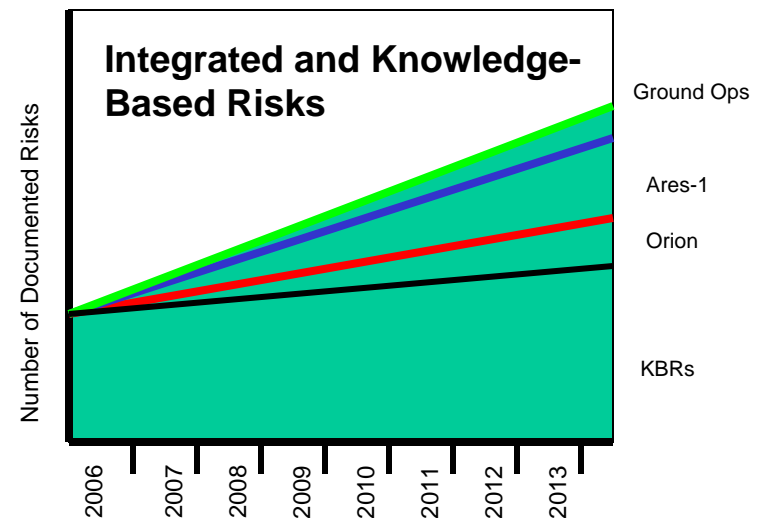
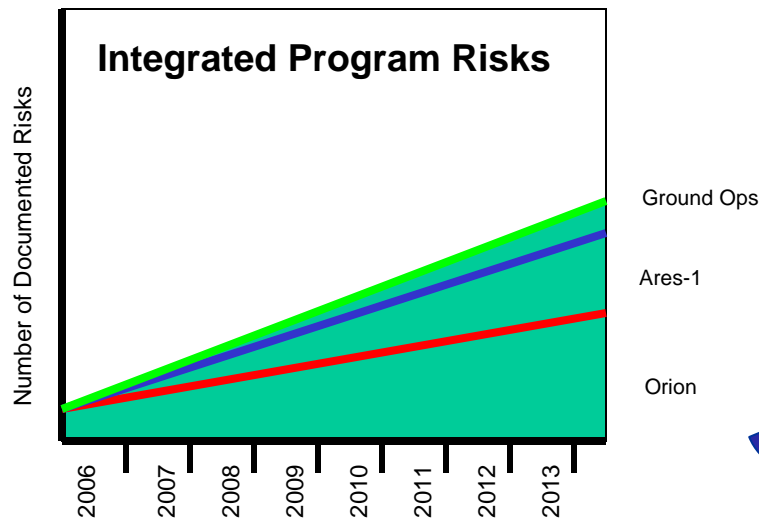
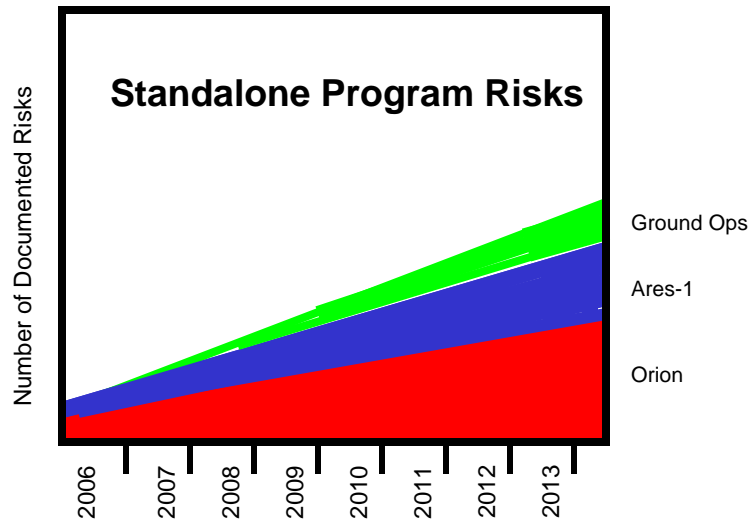
**Reuse...**

**Repeat...**

# Knowledge-Based Risks Over Time

*More access to risk information is required to close “knowledge gaps”*

*KBRs will become a living reference over time as risks are identified, mitigated and closed*



# Knowledge-Based Risks in Risk Tool



# Knowledge-Based Risks in Portal

The screenshot displays a web browser window titled "Risk and Knowledge Management > Identification of Risk - Windows Internet Explorer". The address bar shows a URL from NASA's Exploration Information System (EIS). The left sidebar contains a navigation menu with categories like Project management, Systems Engineering, Safety & Mission Assurance, Science/Technology, Payload, Spacecraft, Mission Operations System, Launch Vehicle/Services, Ground System(s), Systems Integration/Testing, Education/Outreach, and Discussion Boards. The main content area is titled "Identification of Risk" and features a video player for "Integrating Redundancy into Highly Reliable Systems - KBR 4713" by Michael Lutomski. The video player includes a play button, a progress bar, and a timestamp of 5:24. To the right of the video is a transcript of the video content. Below the video player, there are sections for "Related Knowledge Bundles" and "Related Content".

**Identification of Risk**

**Integrating Redundancy into Highly Reliable Systems**

**Risk Statement:** Given that a function is designed with the proper level of redundancy; there is a possibility that single point failures associated with the manufacturing and/or integration of the system or spacecraft can cause complete loss of function or defeat like redundancy.

**Video**

Integrating Redundancy into Highly Reliable Systems  
- KBR 4713  
2.0 Systems Engineering

**Transcript**

Integrating Redundancy into Highly Reliable Systems - Identification of Risk (transcript)  
During the 13A mission, what happened is we lost all three of the central computers and all three of the terminal computers, which are in what we call lanes below them. These are the computers that provide all, essentially all of the critical functions for the service module, which include the Attitude Control System, or the Motion Control System depending on if you use the Russian or the American acronym, the life support system, the thermal control system, you know so your oxygen generation, your CO2 scrubbing, all those critical systems were lost during this failure.

Typically over the years we've had many of these computers fail and get single vent upsets and fail and crash and so forth, and typically not running with all six computers. And so you'll reboot them and go to another string, reboot the first string, and then mode back and forth between your different strings of redundancy, and so it's not really a big deal but when we did this during

**Related Knowledge Bundles**

- Integrating Redundancy into Highly Reliable Systems - Mitigation of Risk

**Related Content**

- Design features related to the June 2007 ISS Computer Shutdown Anomaly & Recovery

- Embedded 3-5 min Video Nugget with Transcript
- Related Knowledge Bundles
- Related Content – Reports, Documents, etc.
- Threaded Discussion (Blog) Feature Allows Comments on Each KBR
- Hosted on ESMD R&KM portal

<https://ice.exploration.nasa.gov/ice/site/km/kbr/>

## ***Practice 4: Web-Enabled Teams***

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**Knowledge resides with people and is often lost via actions like:**

- **Downsizing**
- **Retirements**
- **Shuttle Transition**
- **People Movement**

**The notion of using communities of practice (CoPs) as a fundamental building block of a solid knowledge management system was reviewed by ESMD.**

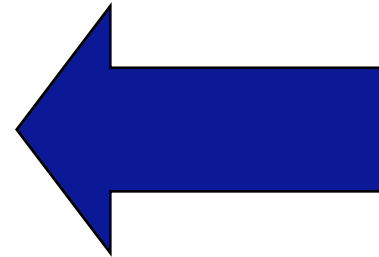
**The implementation of CoPs—especially discipline-specific, top-down approaches—demands change, as evidenced by the lack of support for participating in these types of CoPs and the explosion of virtual teams in ESMD's wiki environment.**

**ESMD has developed a strategy to enhance team communication and performance in a virtual environment through the promotion of both workgroup, wiki functionality, meeting collaboration tools.**

# Web-Enabling ESMD Teams in a Secure Environment

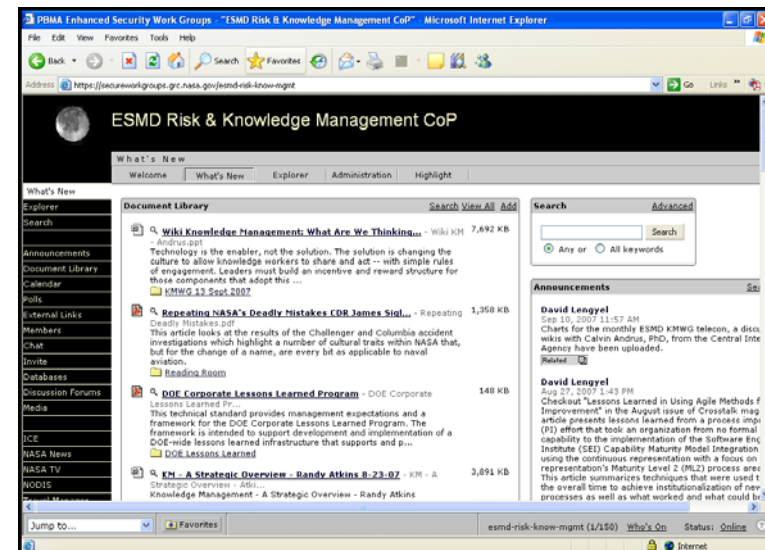


The PBMA toolkit provides ESMD Teams with a secure environment to share documents, conduct threaded discussions & polls, manage calendars, locate expertise, collaborate and learn. Over 30 ESMD Teams are serviced by PBMA.



The ESMD Wiki provides secure collaborative functionality within the ESMD Integrated Collaborative Environment (ICE). ESMD Wiki spaces now number over 300

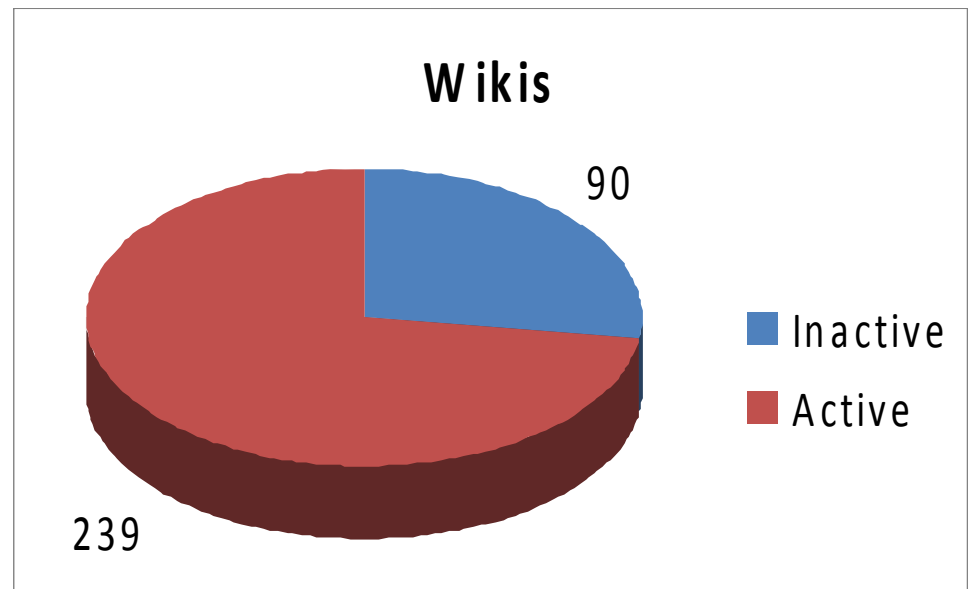
<https://secureworkgroups.grc.nasa.gov/>



# ***ESMD Wiki Statistics***

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- Since the inception of the ICE Wiki it has grown to over 4,000 active users.
- There are 329 unique Wikis, of which 72% are active.
- Inactive status largely reflects the “here is your wiki” deployment of ESMD wikis
- Implementation challenges remain to broaden participation and utilization
- ESMD provides “Virtual Team” training, which includes mapping business processes and information architecture into the wiki environment as well as social aspects to team operations



# ***Practice 5: Knowledge Sharing Forums / Techniques***

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## **Knowledge Sharing Forums and Workshops:**

- **Subject Matter Experts and senior project leaders share their insights, what they learned and what they might have done differently based on project experience.**
- **ESMD typically captures these forums and workshops in video / audio and posts to portal**

## **ESMD Alumni Sharing Events:**

- **These events bring in alumni from Apollo, Space Shuttle, and other programs to discuss their experiences and lessons learned**
- **ESMD has invited selected alumni to brown bag lunches and other lessons learned forums**

## **APPEL Master's Forums:**

- **Conducted twice annually**
- **ESMD has and will continue to participate in these events**

**Knowledge Café technique (small group, structured and unstructured discussion and brainstorming) have been used to complement ESMD knowledge sharing events**

# ***Practice 6: Risk Management Case Studies***

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## **Case Studies**

- **ESMD is developing risk management case studies (multi-media) that help personnel develop better risk identification, analysis and mitigation planning skills**

## **Project Management and Engineering Training**

- **Utilize existing APPEL case studies**
- **ESMD is helping to shape existing courses by providing ESMD-related experiences, risk records, KBRs, and other sources of lessons**
- **Air Force Institute of Technology as well as other case studies are also used for teaching purposes**

# Risk Management Case Studies – Structure & Delivery

**Background:  
Describe the Situation**



**Present the Problem:  
with  
Figures/Data/Video**



**Discussion: Identify  
Possible Solutions**



**Discussion: Analyze  
Possibilities/Trades**



**Decision: Final  
Solution and Outcome.  
Video Conclusions**

## Facilitated Group Discussion



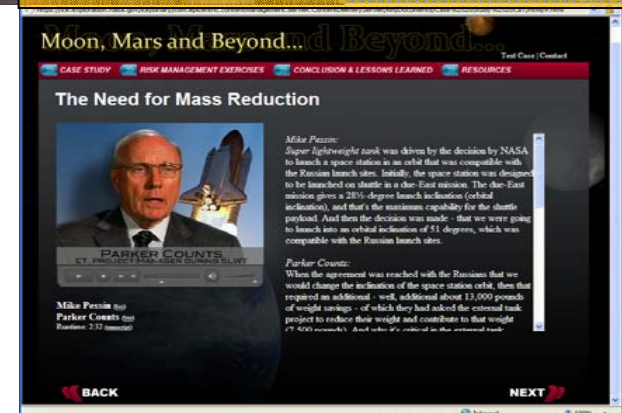
**“Answers” are not given.  
They are arrived at by the  
group members through  
facilitated interaction.**

## The Solo User



## Web-based Collaboration (wiki)

**Computer “simulates”  
facilitation for the  
individual user.**



# Super Light Weight Tank Case Study

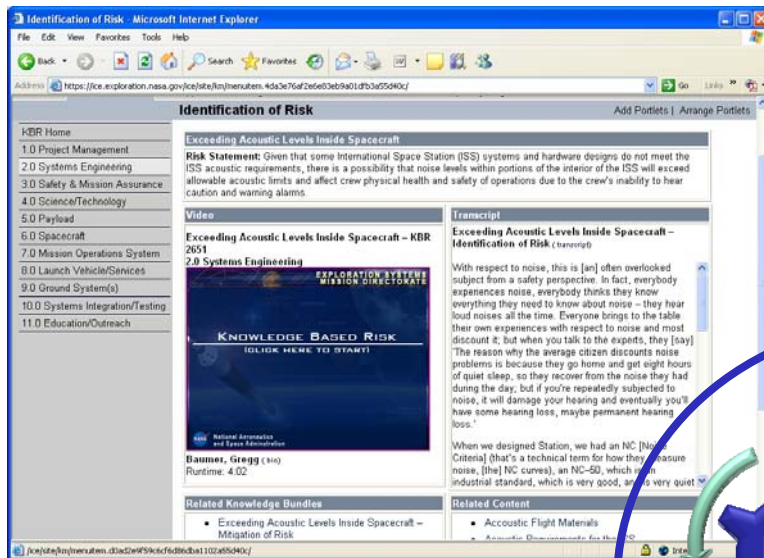


ESMD RM cases studies are portal-based, multi-media teaching aids

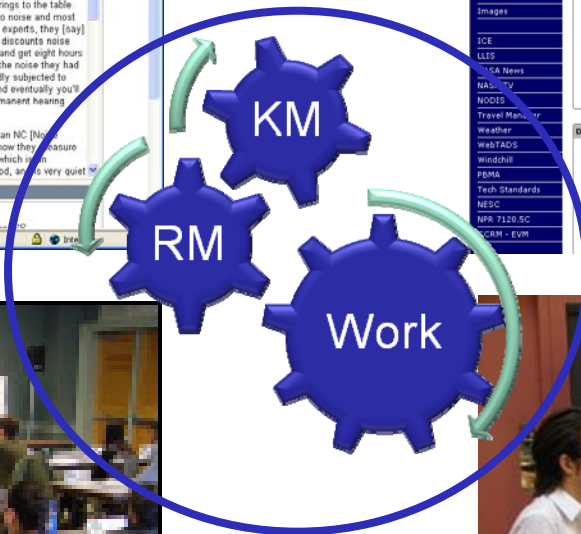
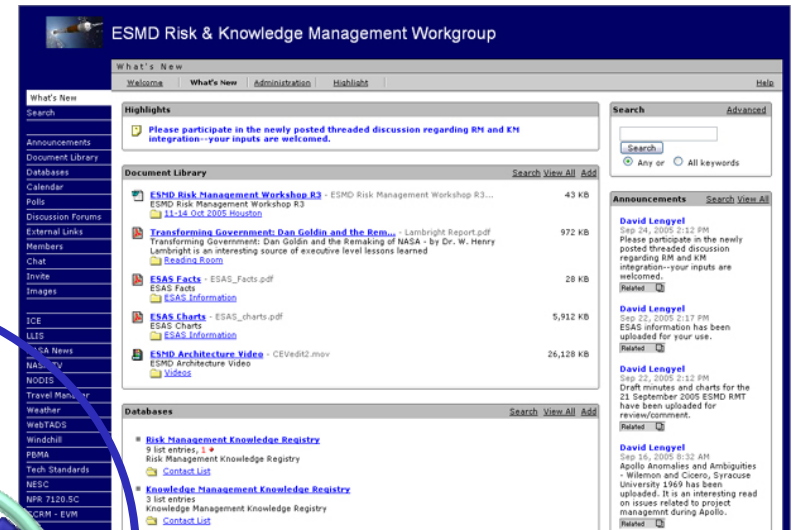
The desired learning objectives include: understanding complex technical and programmatic issues in a risk management framework; demonstrating risk identification and mitigation planning capabilities

Cases may be instructor-led or self-paced (or a combination of both)

# KM Practices and Tool Integration



Web-Enabled Teams / Portals / Wikis



PaLs / Case Studies / Knowledge-Sharing Forums



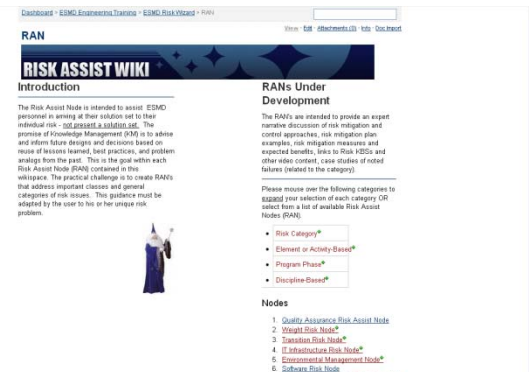
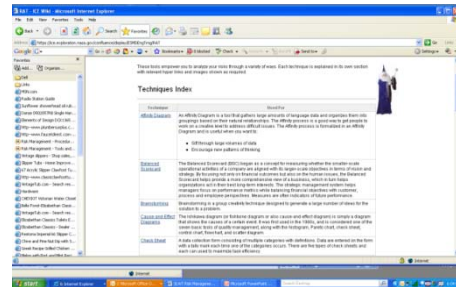
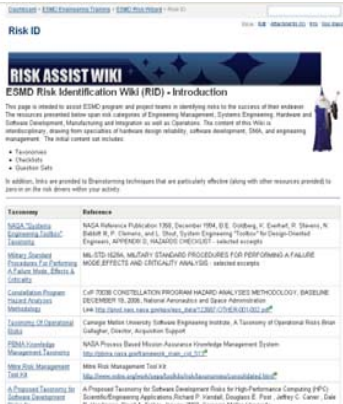
# ***What's On The Horizon? The Risk Wizard***

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# The ESMD Risk Wizard

- **Risk Identification (RID) Wiki**
  - Identify risks
- **Risk Assessment Tool (RAT) Wiki**
  - Assessment methodologies, tools and techniques
- **Risk Assist Nodes (RAN) Wiki**
  - Develop risk mitigation plans



- **Provides Help in Identifying Various Kinds of Risks**
  - Multi-discipline Subject Matter
  - Structured logic techniques
  - Taxonomies
  - Checklists
  - Question Sets
  - Past Failure Case Studies
- **Provides tools and techniques useful in all phases of risk management**
- **Qualitative and Quantitative analysis techniques**
- **Problem Solving Approaches**
- **Process Improvement Methods**
- **Supports development of risk mitigation plans for selected classes and categories of risk**
- **Provides best practices and guidance for life-cycle management of risks within class or category**

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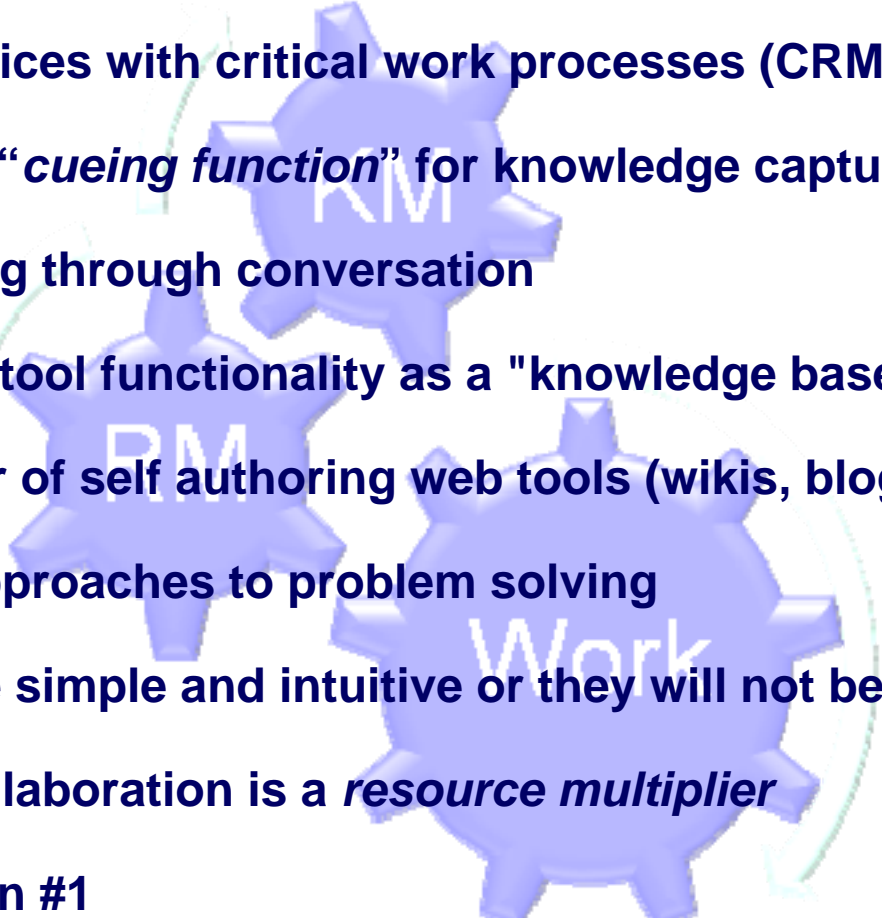
**“You've got to be very careful if you don't know where you're going, because you might not get there.”**

**Yogi Berra**

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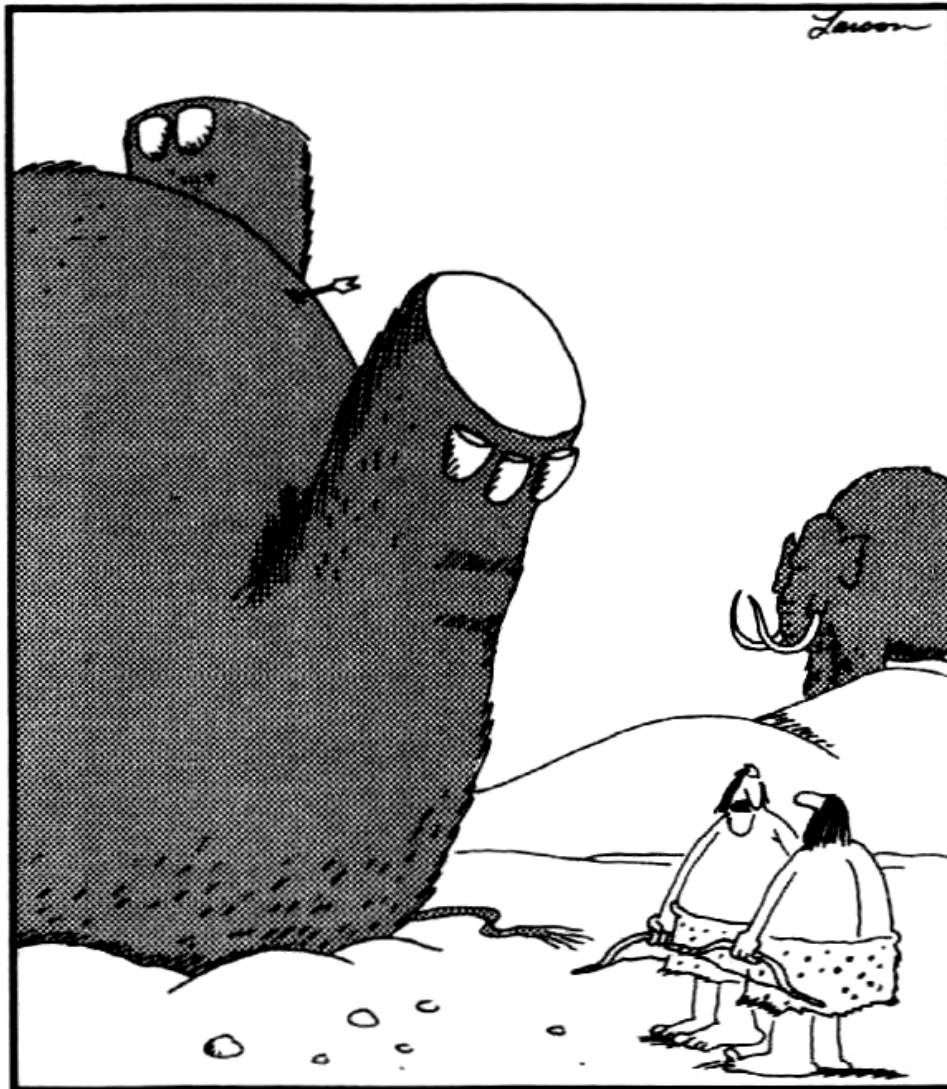
## ***Top Ten Risk & Knowledge Management Lessons to Date***

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- Maintain the focus on enabling the accomplishment of WORK**
  - Integrate KM practices with critical work processes (CRM, SE, etc.)**
  - Employ risks as a “*cueing function*” for knowledge capture / transfer**
  - Emphasize learning through conversation**
  - Maximize existing tool functionality as a "knowledge base"**
  - Harness the power of self authoring web tools (wikis, blogs)**
  - Pilot innovative approaches to problem solving**
  - Insist that tools be simple and intuitive or they will not be used**
  - Recognize that collaboration is a *resource multiplier***
  - Never forget lesson #1**

# Questions?

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"We should write that spot down."

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# ***ESMD Risk & KM Teaming***

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## ESMD is teamed with:

- Space Operations Mission Directorate
- Office of Safety & Mission Assurance
- Office of the Chief Engineer
- NASA HQ Institutions & Administration
- Academy of Program / Project & Engineering Leadership
- NASA Engineering & Safety Center (NESC) Academy
- JSC Chief Knowledge Officer
- GSFC Chief Knowledge Officer
- MSFC / Ares Chief Knowledge Officer
- Constellation Program
- ISS Program
- SSP Program
- Pratt-Whitney-Rocketdyne Chief Knowledge Officer
- Lockheed-Martin
- ATK-Thiokol
- United Space Alliance, Office of the Chief Engineer
- The Aerospace Corporation
- Mitre Corporation
- The JHU Applied Physics Lab
- NASA Alumni Association
- Defense Acquisition University – Best Practices Clearinghouse